

**WHAT IS CLAIMED IS:**

1. A self-healing WDM (Wavelength Division Multiplexing) – PON (Passive Optical Network) apparatus having a CO (Central Office), a RN (Remote Node) and a plurality of subscriber units, comprising:

5       a trunk working fiber and a trunk protection fiber for connecting the CO with the RN; and

      a distribution working fiber and a distribution protection fiber for connecting the RN with the subscriber units,

      wherein the CO contains a 2x2 optical switching unit switched if an error or  
10   communication failure occurs, an upstream working optical receiver and an upstream protection optical receiver for receiving upstream data, and a downstream working light source and a downstream protection light source for transmitting downstream data, and

      wherein each of the subscriber units contains a 2x2 optical switching unit switched if an error or communication failure occurs, a downstream working optical receiver and a  
15   downstream protection optical receiver for receiving downstream data, and an upstream working light source and an upstream protection light source for transmitting upstream data.

      2. The apparatus as set forth in claim 1, wherein the CO further contains an NxN  
20   multiplexer/demultiplexer for multiplexing/demultiplexing upstream/downstream working/protection signals.

3. The apparatus as set forth in claim 1, wherein the RN contains an NxN multiplexer/demultiplexer for demultiplexing multiplexed downstream working/protection signals received from the CO, and multiplexing upstream working/protection signals transferred from the subscriber unit.

4. The apparatus as set forth in claim 1, wherein the CO and the subscriber units each further contain a wavelength division multiplexer (WDM) for adding/dropping upstream/downstream working signals, and another WDM for adding/dropping upstream/downstream protection signals.

5. The apparatus as set forth in claim 2 or 3, wherein the NxN multiplexer/demultiplexer is a WGR (Waveguide Grating Router).

6. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in a working fiber connecting the CO with the RN, the 2x2 optical switching unit contained in the CO and subscriber unit changes to a connection state, such that the CO communicates with the subscriber unit via a protection fiber.

7. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in a working fiber connecting the RN with a subscriber unit, the 2x2 optical

switching unit contained in the subscriber unit changes to a connection state such that the CO communicates with the subscriber unit via a protection fiber.

8. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in a working fiber connecting the RN with a subscriber unit, the 2x2 optical switching unit contained in each subscriber unit and remaining subscriber units and the 2x2 optical switching unit contained in the CO changes to connection states, such that the CO communicates with the subscriber unit and the remaining subscriber units via a protection fiber.

9. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in an upstream working light source contained in a subscriber unit, the 2x2 optical switching unit contained in the subscriber unit changes to a connection state, and the upstream protection light source and the downstream protection optical receiver are driven such that the CO communicates with the subscriber unit.

10. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in the downstream working optical receiver contained in the subscriber unit, the 2x2 optical switching unit contained in the subscriber unit changes to a connection state and the upstream protection light source and the downstream protection optical receiver are driven to perform communication between the CO and the subscriber unit.

11. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in the downstream working light source contained in the CO, the downstream protection light source and the upstream protection optical receiver are driven, and the 2x2 optical switching unit contained in the subscriber unit changes to a connection state, such that the CO communicates with the subscriber unit.

12. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in the upstream working optical receiver contained in the CO, the 2x2 optical switching unit contained in the subscriber unit changes to a connection state and the downstream protection light source and the upstream protection optical receiver are driven to perform communication between the CO and the subscriber unit.

13. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in the downstream working light source contained in the CO, the downstream protection light source and remaining downstream protection light sources are driven, and the 2x2 optical switching unit contained in the CO changes to a connection state, such that the CO communicates with the subscriber unit and remaining subscriber units.

14. The apparatus as set forth in claim 1, wherein, if an error or communication failure occurs in the upstream working optical receiver contained in the CO, the 2x2 optical switching unit contained in the CO changes to a connection state and the downstream protection light source and remaining downstream protection light sources are driven to perform communication between the CO and the subscriber unit and remaining subscriber units.

15. A self-healing WDM (Wavelength Division Multiplexing) – PON (Passive Optical Network) apparatus having a CO (Central Office), a RN (Remote Node) and a plurality of subscriber units, comprising:

a trunk working fiber and a trunk protection fiber for connecting the CO with the  
5 RN; and

a distribution working fiber and a distribution protection fiber for connecting the RN with the subscriber units,

wherein the CO contains an upstream working optical receiver for receiving upstream data, a downstream working light source for transmitting downstream data, a first  
10 optical switching unit for switching to a connection state so that the CO communicates with a subscriber via the trunk protection fiber if an error or communication failure occurs in the trunk working fiber, and

wherein each of the subscriber units contain a downstream working optical receiver for receiving downstream data, an upstream working light source for transmitting upstream  
15 data and a second optical switching unit for switching to a connection state so that the CO communicates with a subscriber via the distribution protection fiber if an error or communication failure occurs in the distribution working fiber.

16. The apparatus as set forth in claim 15, wherein the CO further contains an NxN  
20 multiplexer/demultiplexer for multiplexing/demultiplexing upstream/downstream working/protection signals.

17. The apparatus as set forth in claim 15, wherein the CO further contains a downstream protection light source and an upstream protection optical receiver.

18. The apparatus as set forth in claim 15, wherein each of the subscriber units  
5 further contain an upstream protection light source and a downstream protection optical receiver.

19. The apparatus as set forth in claim 15, wherein the CO and the subscriber units  
each further contain a wavelength division multiplexer (WDM) for adding/dropping  
10 upstream/downstream working signals, and another WDM for adding/dropping  
upstream/downstream protection signals.

20. The apparatus as set forth in claim 16, wherein the NxN  
multiplexer/demultiplexer is a WGR (Waveguide Grating Router).

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